EODERMDROMES AND NON-CHESSWORDS

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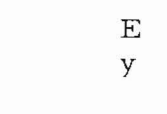
In the February 1968 Word Ways (the first issue), Temple G. Porter presented a word chess puzzle; he asked readers to trace out as many words as possible using only King's moves on a 5-by-5 chessboard inscribed with 25 different letters. In the February 1970 issue, Jean Sabine posed an interesting and still unanswered word chess problem: how should one arrange the 25 different letters to maximize the number of words that can be so traced?

Let us use the term chessword to denote a word that can be traced out by King's moves on a chessboard for at least one assignment of letters to chessboard squares. Each letter appears only once on the grid, no matter how many times it appears in the word. A little experimentation soon reveals that chesswords are very easy to find; in fact, the challenge is to discover words which cannot be thus traced out no matter how letters are assigned to squares. These are termed non-chesswords.

Non-chesswords are very similar to eodermdromes, introduced in a pair of articles in the August 1980 issue of Word Ways. For any word, write down its different letters on a sheet of paper and connect them by links in the order in which the word is spelled (forming a spelling net). If, no matter how the letters are placed on the paper, it is necessary that at least two links in the spelling net must cross each other, the word is called an eodermdrome. Spelling nets of this nature occur if and only if they can be reduced (by erasing superfluous links, as well as letters which have only two links emanating from them) to either (1) five letters with all letters joined by links (a pentagon with an inscribed star), or (2) three letters joined by links in all possible ways to three other letters (the so-called utilities problem in recreational mathematics).

It is somewhat surprising to discover that non-chesswords occur as a result of conditions analogous to (1) and (2). For instance, suppose that one has a word with five different letters, in which each letter occurs adjacent to every other one (as in EODERMDROME). Four letters (say, ABCD) can be accommodated by King's moves if placed in a square, but there is no way the fifth letter, E, can reach each of the others: if a chessword is to occur, it must contain at least a trigram of the form ExB (in-



stead of EB) and at least a tetragram of the form EyzD (instead of ED). Similarly, suppose that one has a word with six different letters in two groups of three, in which each letter from one group occurs adjacent to each letter from the other (as in METASOMATOSES, with the groups MTS and EAO). Two letters (say, AB) from one group can always join with three letters (say, DEF) from the other; however, if a chessword is to occur, C and D must appear in at least a tetragram CxyD (instead of CD).

```
   x
y  A  C
D  E  F
   B
```

Note that these requirements for chesswords are necessary but not sufficient -- that is, if the conditions are not fulfilled a chessword is impossible, but even when the conditions are fulfilled a chessword may fail because of other blockages. Before chesswords are fully understood, all reasons for failure must be specified.

Most eodermdromes are non-chesswords as well, because the additional restrictions needed for conversion to a chessword, outlined above, do not often occur in dictionary words. A few eodermdromes, however, are chesswords; these are diagrammed below.

enterogastrones (15)

```
   A
S  N  G
E  T  O
   R
```

sphincteroscopes (16)

```
      I  H
N  S  P
C  O  E
   T  R
```

hypsibrachycephaly (18)

```
      B
R  L  I
A  H  Y  S
   C  P
      E
```

proletarianization (18)

```
   E
T  N  L
A  I  O
Z  R  P
```

intercontradictory (18)

```
      A
D  C  R  Y
I  O  T  E
   N
```

hyperarchaeological (18)

```
         Y
      H  R  P
      C  A  E
I  G  O  L
```

cholecystolithiasis (19)

```
      Y  A
   C  I  S
E  L  H  T
      O
```

pectinatodenticulate (20)

```
         D
   P  E  O
   C  T  N
   U  I  A
      L
```

electrometallurgical (20)

```
      G
I  A  R  U
C  T  L  O
   E  M
```

Conversely, can one find non-eodermdromes (words with planar spelling nets) that are non-chesswords? A word in which a letter has nine or more different neighbors is automatically a non-chessword, for a letter on a chessboard can be bordered by only eight others. The only known example is the longest-known non-eodermdrome, SUPERCALIFRAGILISTICEXPIALIDOCIOUS, with ten different letters adjacent to I.

The longest-known dictionary chessword is the 28-letter ANTIDISESTABLISHMENTARIANISM, diagrammed at the right; conversely, the shortest non-chessword known is the same as the shortest eoderm-drome, the 13-letter METASOMATOSES. Can readers improve on either of these?

```
  E M H
N T S
A I D
R B L
```

Given that a chessword has been written in grid form, it is not easy to determine what the original word is. For long words, the grid form may well be unique -- that is, correspond to only one chessword. (The converse is almost never true; a chessword usually has several different grid forms, apart from rotations and reflections.) An unsolved problem: what is the largest grid corresponding to two or more orthographically-distinct chesswords (not merely a word and its plural, or variant spellings of the same word)? One's name written in grid form might be a unique "signature", a code unknown except to the initiate; a 3-by-3 example for MARTIN GARDNER was given in the May 1981 Colloquy.

CRYPTOGRAMS AND SPYGRAMS

This newly-published (1981) how-to-do-it Dover book of 112 pages, available in paperback for only $3.50, is authored by American Cryptogram Association member and Games magazine columnist Norma Gleason. A relative newcomer to cryptography, she has skillfully organized her subject-matter to appeal to both the novice and the intermediate solver -- the former is given clues at the end of each cryptogram, which the latter can ignore. By selecting suitably simplified versions of cipher types, she is able to carry the reader surprisingly far, from simple substitution ciphers with and without word divisions, to Baconian ciphers, ADFGX ciphers, nihilist transpositions and route transpositions. Furthermore, her cryptogram examples are uniformly fair to the solver; there are no concatenations of weird words or strained phraseology to throw off letter or bigram statistics.